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(71)Applicant : FURUKAWA ELECTRIC CO LTD:THE
(72)Inventor : YANAGAWA YUTAKA
OGIWARA YOSHIAKI

(54) ANTICORROSION Al ALLOY COMPOSITE MATERIAL FOR HEAT EXCHANGER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an Al alloy composite material having a high anticorrosion property which can be formed into a tube through a folding process and exerts an excellent anticorrosion property in both alkaline and acidic conditions.
SOLUTION: An Al alloy composite material for use in a heat exchanger has a three-layered structure in which a core material made of Al alloy is cladded with a wax material at one surface thereof while the other surface is cladded with a sacrificial anode material. The wax material is Al alloy consisting of a balance of Al and unavoidable impurities and comprising 6.0-12.0 wt.% (hereinafter abbreviated as %) of Si and 0.01-0.3% of Li. The sacrificial anode material is also Al alloy consisting of a balance of Al and unavoidable impurities and comprising 0.3-1.5% of Mg, 0.5-1.5% of Mn and 1.0-6.0% of Zn.

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In aluminum alloy composite for heat exchangers of the three-tiered structure which carried out the clad of the wax material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other one side of a core material About said wax material, it is Si. 6.0 - 12.0 % of the weight (it is hereafter written as %), Li Contain 0.01 - 0.3% and it considers as aluminum alloy which consists of the remainder aluminum and an unescapable impurity. About said sacrificial anode material, it is Mg. 0.3 - 1.5%, Mn 0.5 - 1.5%, Zn Corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 1.0 - 6.0% and consists of the remainder aluminum and an unescapable impurity.
[Claim 2] It sets to aluminum alloy composite according to claim 1, and is Si about a core material. 0.05 - 1.2%, Fe 0.05 - 0.8%, Cu 0.05 - 1.2%, and Mn Corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 0.05 - 2.0% and consists of the remainder aluminum and an unescapable impurity.
[Claim 3] It sets to aluminum alloy composite according to claim 1, and is Si about a core material. 0.05 - 1.2%, Fe 0.05 - 0.8%, Cu 0.05 - 2.0% of Mn is contained 0.05 to 1.2%. Furthermore, Mg 0.03 - 1.0%, Cr 0.03 - 0.3%, Zr 0.03 - 0.3%, Ti Corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains one sort chosen from the group which consists of 0.03 - 0.3%, and 0.05 - 2.0% of nickel, or two sorts or more, and consists of the remainder aluminum and an unescapable impurity.

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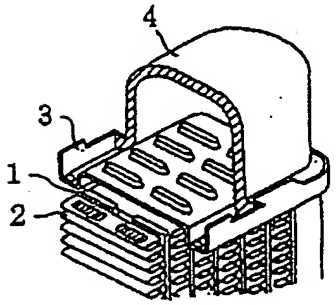
Drawing selection drawing 1



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JAPANESE [JP,2000-297996,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to aluminum alloy composite which tube tubing which was excellent in both acid and alkaline environments in more detail at corrosion resistance is obtained, and can make the heat exchanger manufactured with tube tubing whose lightweight-ization is attained, and in which bending processing is possible about the suitable heat exchange dexterous corrosion resistance aluminum alloy composite for tube tubing of the heat exchanger for automobiles manufactured by soldering.
[0002]
[Description of the Prior Art] Heat exchangers, such as a radiator, form in one the light-gage fin (2) into which it was processed in the shape of corrugated one between two or more flat tube tubing (1) as shown in drawing 1 . The space which consists of a header plate (3) and a tank (4) is made to carry out opening of the both ends of said flat tube tubing (1), respectively. The refrigerant which carried out heat exchange of the elevated-temperature refrigerant to the space by the side of the tank (4) of another side in the parts of delivery, tube tubing (1), and a fin (2) through the inside of flat tube tubing (1) from the space in one Tanggu, and became low temperature is circulated again. Tube tubing of such a heat exchanger makes for example, JIS-3003 alloy a core material, and what used as tubing JIS-7072 alloy and composite (brazing sheet) which usually carried out the clad of the wax material, such as JIS-4343 alloy and JIS-4045 alloy, to the outside of said core material is used as sacrificial anode material at the side which is always touching the inside of said core material, i.e., the aforementioned refrigerant. And it joined to one that I will assemble and shine with other members, such as a fin which performed corrugated processing, and the heat exchanger has been obtained. As a soldering method of construction, the saw lock blazing method using non-corrosive fluoride flux is performed, for example, and it heats to the temperature near 600 degree C, and is soldered.
[0003] In order to have obtained tube tubing conventionally using said composite, conventionally, the sacrificial anode material (7) layer was carried out inside, and ******** which carried out the laminating of wax material (6) and the sacrificial anode material (7) to drawing 2 to both sides of a core material (5), respectively as a cross-section configuration showed was fabricated in the shape of a pipe, and was compared by **** processing, and the section (8) was welded and it was manufactured. On the other hand, manufacturing tube tubing of the configuration currently indicated by JP,2-75414,A after that was proposed. Bend this so that a sacrificial anode material (7) layer may become drawing 3 with the inside about the both-sides section of said ********, as a cross section shows, and it dashes these both-sides section against a sacrificial anode material (7) layer. And by [which compare and forms Section A] having joined mutually the wax material (6) of a both-sides section front face, and having joined the end face of a core material (5) to sacrificial anode material After shaping, core **** is performed combining a fin and tube tubing (11) which formed the refrigerant path (9) in both sides, respectively is joined by soldering.
[0004] By the approach of forming tube tubing by bending processing like this drawing 3 , when the

thinning of the ******** as shown in ** drawing 2 is carried out, there is a problem to which **** processing becomes very difficult, but since **** processing of ** is not performed in the approach by bending processing shown in drawing 3 , even if it carries out the thinning of the ********, it is made to tube tubing at preparation.
** Two ****s of tube tubing are carried out, and since the inside column (10) joined [each other] can be prepared, the pressure resistance of a heat exchanger becomes high. There is a merit to say, and since the approach of forming tube tubing by bending processing can carry out [lightweight]-izing of the heat exchanger more easily than the approach by **** processing, it has been circulated quickly in recent years. Moreover, although the neutral - acid refrigerant has been conventionally used as said refrigerant of a heat exchanger, the alkaline refrigerant is also used and, in addition to the corrosion resistance in the acid conventional environment, the ingredient in which good corrosion resistance is shown also in an alkaline environment is demanded as composite for tube tubing in recent years. And the advanced composites (JP,9-176768,A etc.) which added various alloy elements to sacrificial anode material for the purpose of corrosion-resistant improvement in an alkali environment are proposed as an object for tube tubing.
[0005]
[Problem(s) to be Solved by the Invention] However, in the place where this invention person etc. examined said advanced composite, it became clear with said advanced composite that sufficient corrosion resistance was not acquired in an alkaline environment. As this cause, it is ********** in a putting [since the aluminum-oxide coat of a sacrificial anode material front face dissolves promptly in ** alkali environment, a substrate metal will be exposed at an early stage, and / a substrate metal]-to alkali environment ** alkali environment that the dissolution rate of a substrate metal is very large. this invention person etc. could advance research wholeheartedly, could consider as tube tubing by bending processing, and succeeded in development of aluminum alloy composite which has the corrosion resistance which was excellent in both alkaline and acid environments.
[0006]
[Means for Solving the Problem] In aluminum alloy composite for heat exchangers of the three-tiered structure which invention according to claim 1 carried out the clad of the wax material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other one side of a core material About said wax material, it is Si. 6.0 - 12.0 % of the weight (it is hereafter written as %), Li Contain 0.01 - 0.3% and it considers as aluminum alloy which consists of the remainder aluminum and an unescapable impurity. About said sacrificial anode material, it is Mg. 0.3 - 1.5%, Mn 0.5 - 1.5%, Zn It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 1.0 - 6.0% and consists of the remainder aluminum and an unescapable impurity. It sets to aluminum alloy composite according to claim 1, and invention according to claim 2 is 0.05 - 1.2% of Si, and Fe about a core material. 0.05 - 0.8%, Cu 0.05 - 1.2%, and Mn It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 0.05 - 2.0% and consists of the remainder aluminum and an unescapable impurity. Invention according to claim 3 is set to aluminum alloy composite according to claim 1. A core material 0.05 - 1.2% of Si, Fe 0.05 - 0.8%, Cu 0.05 - 1.2%, Mn 0.05 - 2.0% is contained. Furthermore, Mg 0.03 - 1.0%, 0.03 - 0.3% of Cr(s), Zr 0.03 - 0.3%, Ti 0.03 - 0.3%, and nickel It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains one sort chosen from the group which consists of 0.05 - 2.0%, or two sorts or more, and consists of the remainder aluminum and an unescapable impurity. In this invention, although alkalinity is specifically eight or less pH although especially an alkaline and acid definition does not differ from usual, and acidity says five or less pH, it is not restricted to this.
[0007]
[Embodiment of the Invention] Next, this invention is further explained to a detail based on an embodiment. aluminum alloy sacrificial anode material of invention of claim 1 gives alkali resistance to sacrificial anode material by making aluminum contain Mg. By adding Mg to sacrificial anode material, a magnesium-oxide coat is formed in a sacrificial anode material front face after soldering heating. Since

said magnesium-oxide coat has the dissolution rate very smaller than an aluminum-oxide coat in an alkali environment, exposure of a substrate metal can be made delayed sharply. Moreover, although it is accompanied by the hydrogen generating reaction in case aluminum dissolves in an alkali environment, by making sacrificial anode material carry out specified quantity content of Mn, the hydrogen overvoltage of sacrificial anode material can be enlarged and the dissolution at a hydrogen generating reaction, i.e., an alkali environment, can be controlled. Furthermore, in addition, the hydrogen overvoltage of sacrificial anode material can be further enlarged by making sacrificial anode material add Zn of the specified quantity. While making the dissolution in an alkali environment control further by this, in an acidity - neutral environment, natural electrode potential of sacrificial anode material can be made into **, an original sacrifice corrosion prevention operation can be demonstrated, and the corrosion resistance in an acid environment can be secured.

[0008] As mentioned above, by making a proper quantity of Mg, Mn, and Zn live together in sacrificial anode material showed that alkalinity and the outstanding corrosion resistance in an acid environment could be given to tube tubing. However, when Mg is added to the sacrificial anode material of aluminum alloy composite, there is a problem that aluminum alloy composite cannot be used as said bending tube tubing. This is because the fluoride flux used as flux and Mg in sacrificial anode material react, the effectiveness of flux is lost in order to form a high-melting compound, and soldering becomes impossible. It turned out that this invention person etc. can advance research further wholeheartedly, is adding Li of the specified quantity to the wax material of said composite, and can manufacture tube tubing as a bending tube and it can solder as a heat exchanger even when Mg contains in sacrificial anode material.

[0009] Since LiF will be formed before MgF forms if Li is added to wax material, this is considered because there is an operation which controls formation of MgF which checks soldering nature. Since this LiF is in a melting condition in flux, it deposits as a solid-state like MgF with the high melting point, and is not said that the flow of a wax is checked. Furthermore, since Li is effective in reducing the surface tension of aluminum alloy remarkably, it raises the flow nature of a wax. By making wax material add Li of the specified quantity according to such effectiveness, when Mg content of sacrificial anode material was 1.5% or less, it became clear by the approach of using as tube tubing by bending processing that a heat exchanger with good soldering was obtained.

[0010] In invention of claim 1, the reason for specifying Mg content of sacrificial anode material to 0.3 - 1.5% is that the effectiveness of alkali-proof improvement is not fully acquired since a magnesium-oxide coat is not completely formed in a sacrificial anode material front face for Mg content at less than 0.3%. If Mg content exceeds 1.5%, since excessive Mg will react with flux, Li of this invention will be deposited as MgF, even if it uses specified quantity **** wax material and the flow of a wax will be blocked, tube tubing bent and processed cannot be soldered. Especially the content of desirable Mg is 0.3 - 1.0%. The reason for specifying Mn content of sacrificial anode material to 0.5 - 1.5% is because the effectiveness that Mn content lowers a hydrogen overvoltage at less than 0.5% is not fully acquired and the dissolution of the substrate metal in an alkali environment cannot be controlled. If Mn content exceeds 1.5%, the rolling workability of sacrificial anode material will fall.

[0011] Moreover, the reason for specifying Zn content of sacrificial anode material to 1.0 - 6.0% is because the effectiveness that Zn content lowers a hydrogen overvoltage at less than 1.0% is not fully acquired and the dissolution of the substrate metal in an alkali environment cannot be controlled. Furthermore, since natural electrode potential of sacrificial anode material cannot be enough made into **, the sacrifice corrosion prevention effectiveness over a core material will run short, and the corrosion resistance in an acid environment will be inferior. If Zn content exceeds 6.0%, when Mg content is contained in sacrificial anode material 0.3 to 1.5%, the rolling workability of sacrificial anode material will fall. Especially the content of desirable Zn is 2.0 - 6.0%. 0.5% or less, 0.3% or less of Si of the unescapable impurity element in sacrificial anode material is desirable, if it can do. If impurity elements other than Si are 0.05% [or less] each, even if they are contained, they are satisfactory.

[0012] In invention of claim 1, Si of wax material serves to lower the melting point of an alloy. Since the melting point will go up if the melting point of wax material does not fully fall at less than 6.0% but

Si content exceeds 12.0%, the reason for specifying Si content of wax material to 6.0 - 12.0% cannot be soldered. Moreover, the reason for specifying Li content of wax material to 0.01 - 0.3% is that a thick oxide film will be formed in the front face of sacrificial anode material of oxidation of Li, and soldering nature will fall if the effectiveness that Li content controls formation of MgF required for soldering for the sacrificial anode material which contains Mg at 0.01% or less is not enough and Li content exceeds 0.3%. aluminum alloy composite of this invention makes said aluminum alloy sacrificial anode material one side of aluminum alloy core material, and makes the clad of said aluminum alloy wax material to other one side.

[0013] Next, the alloy element of claim 2 and aluminum alloy core material according to claim 3 is explained. After soldering, Si dissolves in a matrix and raises the reinforcement of a core material. At less than 0.05%, the reason for specifying the content of Si to 0.05 - 1.2% is for Si to deposit alone and for the self-corrosion resistance of a core material to make it fall, when the effectiveness of raising reinforcement is not fully acquired but exceeds 1.2%. 0.1 - 0.8% of especially the content of Si is desirable. Fe is distributed in a matrix as a big and rough intermetallic compound, makes crystal grain of a core material detailed, and prevents generating of the crack when fabricating in tube tubing. At less than 0.05%, the reason for specifying the content of Fe to 0.05 - 0.8% is for the self-corrosion resistance of a core material to fall, when the effectiveness is not acquired enough but exceeds 0.8%. 0.05 - 0.3% of especially the content of Fe is desirable.

[0014] Cu contributes to the improvement in on the strength of a core material. At less than 0.05%, the reason for specifying the content of Cu to 0.05 - 1.2% is for the melting point to fall and for a core material to fuse locally with heating at the time of soldering, when the effectiveness of raising reinforcement is not acquired enough but exceeds 1.2%. Mn forms a detailed intermetallic compound, is distributed in a matrix, and it raises the reinforcement of a core material, without reducing corrosion resistance. At less than 0.05%, the reason for specifying the content of Mn to 0.05 - 2.0% is for rolling workability to fall, when the effectiveness of raising reinforcement is not fully acquired but exceeds 2.0%. 0.5 - 1.5% of especially the content of Mn is desirable.

[0015] In the core material of aluminum alloy composite of this invention, each Cr, Zr, Ti, and nickel of a selection element form a detailed intermetallic compound, and raise the reinforcement of a core material. The reason for specifying the content of Cr, Zr, and Ti to 0.03 - 0.3%, respectively is for the occurrence frequency of the flume gap to which the effectiveness of all raising reinforcement by Suemitsu 0.03% is not acquired enough, but exceeds 0.3% of a casting crack to increase. Especially the desirable content of these elements is 0.08 - 0.2%, respectively. Although the content of nickel is specified to 0.05 - 2.0%, the reason for a convention is the same as cases, such as said Cr. Especially the desirable content of nickel is 0.08 - 1.0%.

[0016] With Si, Mg of a selection element carries out the aging deposit of the Mg-Si system compound, and raises reinforcement. The reason for specifying the content of Mg to 0.03 - 1.0% is for the amount of Mg diffused even on a wax material front face in the case of soldering to increase, for Surplus Mg to react with fluoride flux, even if it has added Li to wax material like this invention, and for soldering nature to fall, when the effectiveness of raising reinforcement at less than 0.03% is not acquired enough but exceeds 1.0%. If B for making an ingot organization detailed or other unescapable impurity elements are 0.05% [or less] each, even if it contains them, they do not interfere.

[0017]

[Example] This invention is further explained to a detail based on an example.

(Example 1) Metal mold casting of the wax material alloy of this invention convention presentation shown in Table 1, a sacrificial anode material alloy, and the core material alloy was carried out, respectively, facing of the ingot for core materials was carried out to 35mm in thickness, and after facing, the ingot for sacrificial anode material was hot-rolled, and was taken as the plate with a thickness of 10mm. Moreover, after facing, the ingot hot-rolled the wax material alloy and used it as the plate for wax material with a thickness of 5mm. Said plate for sacrificial anode material, the ingot for core materials, and the plate for wax material were hot-rolled at 500 degrees C in piles in this order, it considered as the three-layer clad plate with a thickness of 5mm, and this was cold-rolled in thickness of

0.29mm, after giving intermediate annealing subsequently heated at 340 degrees C for 2 hours, it cold-rolled and aluminum alloy composite (H14 material) with a thickness of 0.25mm was manufactured. The rate of a clad of wax material of the rate of a clad of sacrificial anode material was 10% 20% here. The rate of a clad is expressed with a degree type in this invention.
the rate = sacrificial anode of a clad of sacrificial anode material -- stock thickness -- the rate = wax of a clad of /board thickness x100 wax material -- stock thickness -- /board thickness x -- 100 [0018] (Example 1 of a comparison) The alloy presentation of a core material, sacrificial anode material, and wax material was made into the outside of this invention convention presentation as shown in Table 1, and also aluminum alloy composite was manufactured by the completely same approach as an example 1. About each obtained aluminum alloy composite, the soldering trial and the corrosion resistance test were performed. The corrosion resistance test followed both the acid environment and the alkaline environment. Investigation with the same said of the conventional material was conducted.
[0019] [Soldering trial] Each aluminum alloy composite was cut to 25mmx60mm, and T joint joint soldering trial was carried out. In order to simulate the soldering section of a bending tube, the horizontal plate of T joint joint made the field which touches a vertical panel sacrificial anode material. After applying the non-corrosive fluoride flux which becomes assembled T joint joint from a fluoro ulmin **** RIUMU complex two times 5 g/m, it held for 3 minutes at 600 degrees C in nitrogen gas, and soldered each 30 sets of T joint joints. The existence of a wax piece was evaluated by viewing about the soldered sample. What generating of O and a wax piece was regarded as in what a wax piece was not regarded as at all was made into x. This trial is equivalent to the brazing sex test of the comparison section A in drawing 3 of this invention.
[0020] [Corrosion resistance test] Bending processing was performed, it considered as tube tubing (die length of 500mm, width of face of 16mm of a cross section, height of 2mm), the heat exchanger of the structure shown in drawing 1 using this tube tubing was assembled, and this heat exchanger was made to circulate through alkaline or acid etching fluid (80 degrees C) for three months about aluminum alloy composite which was able to be soldered by said soldering trial. Then, it sampled ten tube tubing at a time at random from each heat exchanger, and the pitting depth of a tube material inside was measured by the depth of focus method using an optical microscope. Measured value was rounded off, was expressed per 5 micrometers, and displayed the maximum depth of them. What carried out corrugated processing of the sheet metal material with a thickness of 0.1mm it is thin from an aluminum-0.5%Si-1.0%Mn-2.0%Zn alloy was used for the fin. it passed and aluminum alloy composite with a thickness of 1.2mm which, on the other hand, looked like [one side of the core material which added Mg 0.15% into JIS-3003 alloy] the sacrificial anode material of an aluminum-1.5%Zn alloy, and carried out the clad of the wax material of JIS-4343 alloy to the DDA plate and the side plate at 10% of rates of a clad, respectively was used.
[0021] The liquid which added NaOH in the water solution which contains Cl-ion 195ppm, SO42-ion 60ppm, Cu2+ ion 1ppm, and Fe3+ ion 30ppm in alkaline etching fluid, and was adjusted to pH11 was used. The water solution (pH3) containing Cl-ion 195ppm, SO42-ion 60ppm, Cu2+ ion 1ppm, and Fe3+ ion 30ppm was used for acid etching fluid. A result is shown in Table 1. In addition, x and the maximum pitting depth appended O to that to which the maximum pitting depth exceeded 100 micrometers in the alkaline corrosion test and the acid corrosion test at the thing 100 micrometers or less.
[0022]
[Table 1]

表1

分類	No.	ろう材組成 %		犠牲陽極材組成%				芯材組成 %						ろう付性	アルカリ性環境	酸性環境
		Si	Li	Zn	Mg	Mn	Si	Fe	Cu	Mn	Cr Zr Ti Mg Ni				最大孔食深さ μm	最大孔食深さ μm
本発明例	1	6.8	0.25	1.2	1.41	0.55	0.37	0.51	0.42	1.52				○	35	60 ○
	2	10.5	0.02	1.8	0.63	1.09	0.34	0.25	0.16	1.10				○	55	55 ○
	3	10.2	0.09	2.1	0.57	0.86	0.22	0.21	0.32	0.98				○	60	50 ○
	4	10.8	0.06	3.6	0.56	0.81	0.31	0.19	0.61	1.06				○	60	40 ○
	5	9.7	0.14	4.1	0.63	1.25	0.33	0.28	0.80	1.23				○	50	45 ○
	6	10.0	0.04	5.5	0.75	1.30	0.48	0.15	0.15	1.05				○	45	30 ○
	7	11.5	0.12	6.1	0.66	0.74	0.61	0.30	0.35	0.94				○	50	80 ○
	8	10.2	0.08	1.4	1.27	1.41	0.61	0.25	0.48	1.15				○	30	60 ○
	9	10.6	0.18	2.7	1.10	0.89	0.64	0.16	0.75	0.89				○	20	65 ○
	10	9.3	0.09	3.2	1.08	1.19	0.81	0.26	0.16	1.32				○	35	60 ○
	11	7.9	0.11	4.6	1.13	0.72	0.96	0.11	0.34	1.40				○	40	45 ○
	12	8.5	0.07	5.7	0.97	1.28	0.76	0.45	0.63	0.79				○	40	35 ○
	13	10.3	0.15	5.2	1.28	1.03	0.71	0.32	0.86	1.10				○	35	35 ○
	14	10.2	0.08	4.0	0.81	0.93	0.12	0.21	0.09	1.52	Cr 0.14			○	45	40 ○
	15	9.6	0.03	3.8	0.92	0.67	1.09	0.70	0.40	0.09	Zr 0.12			○	40	45 ○
	16	10.7	0.09	4.8	1.23	0.88	0.82	0.29	1.03	1.21	Ti 0.18			○	35	55 ○
	17	10.1	0.19	4.2	0.33	0.97	0.42	0.32	0.62	0.98	Mg 0.67			○	55	50 ○
	18	9.6	0.04	3.7	0.97	1.02	0.58	0.10	0.63	1.07	Ni 1.05			○	45	40 ○
比較例	19	10.6	-	2.8	0.76	0.82	0.62	0.34	0.18	1.04				×	熱交換器を製造できなかった	
	20	9.1	0.01	3.6	0.83	0.72	0.54	0.28	0.66	0.94				×	熱交換器を製造できなかった	
	21	10.3	0.63	5.3	1.02	1.04	0.36	0.45	0.45	1.15				×	熱交換器を製造できなかった	
	22	10.9	0.09	3.4	0.34	1.31	0.74	0.18	0.73	1.08				○	貫通 ×	70 ○
	23	10.1	0.07	1.9	1.95	0.94	0.34	0.21	0.42	0.80				×	熱交換器を製造できなかった	
	24	9.4	0.09	0.64	1.01	1.24	0.18	0.32	0.24	0.93				○	85 ○	180 ×
	25	10.5	0.13	10.5	0.96	1.10	0.52	0.27	0.45	1.07	圧延後中で割れて製造不可					
	26	5.2	0.08	2.6	0.82	1.42	0.89	0.46	0.87	1.26				×	熱交換器を製造できなかった	
	27	10.6	0.12	3.6	0.95	0.73	1.35	0.35	0.53	0.88				○	180 ×	140 ×
	28	9.3	0.17	5.3	0.79	0.88	0.41	0.51	1.35	0.79					芯材がろう付け加熱時に溶融	
	29	10.7	0.13	2.7	1.05	1.13	0.63	0.25	0.60	1.32	Mg 1.57			×	熱交換器を製造できなかった	
従来例	30	10.0	-	1.0	-	-	0.31	0.42	0.15	1.10				○	貫通 ×	90 ○

[0023] Li of the specified quantity is contained in wax material, No.1-18 of the example of this invention would shine, the sex was good, since Mg, Mn, and Zn of the specified quantity were contained in sacrificial anode material, in the corrosion test of both alkaline and acid environments, the pitting depth is 100 micrometers or less, and the outstanding corrosion resistance was shown, so that more

clearly than Table 1. On the other hand, the alloy presentation was what the example of a comparison (No.19-29) and the conventional example (No.30) besides this invention convention were inferior to soldering nature, or corrosion resistance fell by alkalinity or the acid corrosion test, or cannot manufacture ******** or a heat exchanger.

[0024] No. -- 19 and 20 had few Li contents of wax material, and since Mg was contained in sacrificial anode material, the wax piece was generated and they were inferior in soldering nature. Since No.21 had too many Li contents of wax material, the wax material front face oxidized violently, the oxide film became thick unusually, and they were inferior in soldering nature. There were few Mg contents of sacrificial anode material, and a substrate metal was not fully protected, and since the dissolution rate of a substrate metal was large, the corrosion resistance in an alkali environment was inferior in No.22, since a magnesium-oxide coat was not fully formed. Since No.23 had too many Mg contents of sacrificial anode material, even if it was making wax material contain Li, the wax piece was generated, and they were inferior to soldering nature. Since No.24 had few Zn contents of sacrificial anode material, sufficient sacrifice corrosion prevention effectiveness was not demonstrated in the acid environment, but corrosion resistance was inferior in them. No.25 had many Zn contents of sacrificial anode material, since they contained Mg further, sacrificial anode material is in the middle of rolling, they broke, and manufacture of composite of them was not completed.

[0025] Since No.26 had few Si contents of wax material, its melting of wax material was imperfect and was not able to solder them. Since No.27 had many Si contents of a core material, the simple substance Si deposited in the core material, and the self-corrosion resistance of a core material fell in alkalinity and both acid environments. Since No.28 have too many Cu contents of a core material, the melting point of a core material fell and the core material of composite has fused them at the time of a soldering trial. Since No.29 had too many Mg contents of a core material, Mg of a core material diffused them at wax material in the middle of soldering heating, they reduced the effectiveness of Li contained in wax material, and were inferior in soldering nature. Moreover, although No.30 were the conventional example, since Mg was not contained in sacrificial anode material, a magnesium-oxide coat was not fully formed, and the dissolution rate of a substrate metal was large, and the corrosion resistance in an alkali environment was inferior.

[0026]

[Effect of the Invention] Thus, aluminum alloy composite of this invention shows the corrosion resistance which was excellent in both alkaline and acid environments, and is high corrosion resistance. Furthermore, since it can consider as tube tubing by bending processing, lightweight-ization of the heat exchanger made from aluminum alloy can be attained by carrying out the thinning of the aluminum alloy composite. Moreover, brazing junction can be performed without performing welding by **** processing, and the thinning of ******** can be performed. Moreover, the pressure resistance of a heat exchanger can be raised by 2 division of a tube. Therefore, remarkable effectiveness is done so on industry.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to aluminum alloy composite which tube tubing which was excellent in both acid and alkaline environments in more detail at corrosion resistance is obtained, and can make the heat exchanger manufactured with tube tubing whose lightweight-ization is attained, and in which bending processing is possible about the suitable heat exchange dexterous corrosion resistance aluminum alloy composite for tube tubing of the heat exchanger for automobiles manufactured by soldering.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Heat exchangers, such as a radiator, form in one the light-gage fin (2) into which it was processed in the shape of corrugated one between two or more flat tube tubing (1) as shown in drawing 1 . The space which consists of a header plate (3) and a tank (4) is made to carry out opening of the both ends of said flat tube tubing (1), respectively. The refrigerant which carried out heat exchange of the elevated-temperature refrigerant to the space by the side of the tank (4) of another side in the parts of delivery, tube tubing (1), and a fin (2) through the inside of flat tube tubing (1) from the space in one Tanggu, and became low temperature is circulated again. Tube tubing of such a heat exchanger makes for example, JIS-3003 alloy a core material, and what used as tubing JIS-7072 alloy and composite (brazing sheet) which usually carried out the clad of the wax material, such as JIS-4343 alloy and JIS-4045 alloy, to the outside of said core material is used as sacrificial anode material at the side which is always touching the inside of said core material, i.e., the aforementioned refrigerant. And it joined to one that I will assemble and shine with other members, such as a fin which performed corrugated processing, and the heat exchanger has been obtained. As a soldering method of construction, the saw lock blazing method using non-corrosive fluoride flux is performed, for example, and it heats to the temperature near 600 degree C, and is soldered.
[0003] In order to have obtained tube tubing conventionally using said composite, conventionally, the sacrificial anode material (7) layer was carried out inside, and ******** which carried out the laminating of wax material (6) and the sacrificial anode material (7) to drawing 2 to both sides of a core material (5), respectively as a cross-section configuration showed was fabricated in the shape of a pipe, and was compared by **** processing, and the section (8) was welded and it was manufactured. On the other hand, manufacturing tube tubing of the configuration currently indicated by JP,2-75414,A after that was proposed. Bend this so that a sacrificial anode material (7) layer may become drawing 3 with the inside about the both-sides section of said ********, as a cross section shows, and it dashes these both-sides section against a sacrificial anode material (7) layer. And by [which compare and forms Section A] having joined mutually the wax material (6) of a both-sides section front face, and having joined the end face of a core material (5) to sacrificial anode material After shaping, core **** is performed combining a fin and tube tubing (11) which formed the refrigerant path (9) in both sides, respectively is joined by soldering.
[0004] By the approach of forming tube tubing by bending processing like this drawing 3 , when the thinning of the ******** as shown in ** drawing 2 is carried out, there is a problem to which **** processing becomes very difficult, but since **** processing of ** is not performed in the approach by bending processing shown in drawing 3 , even if it carries out the thinning of the ********, it is made to tube tubing at preparation.
** Two ****s of tube tubing are carried out, and since the inside column (10) joined [each other] can be prepared, the pressure resistance of a heat exchanger becomes high. There is a merit to say, and since the approach of forming tube tubing by bending processing can carry out [lightweight]-izing of the heat exchanger more easily than the approach by **** processing, it has been circulated quickly in recent years. Moreover, although the neutral - acid refrigerant has been conventionally used as said refrigerant

of a heat exchanger, the alkaline refrigerant is also used and, in addition to the corrosion resistance in the acid conventional environment, the ingredient in which good corrosion resistance is shown also in an alkaline environment is demanded as composite for tube tubing in recent years. And the advanced composites (JP,9-176768,A etc.) which added various alloy elements to sacrificial anode material for the purpose of corrosion-resistant improvement in an alkali environment are proposed as an object for tube tubing.

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EFFECT OF THE INVENTION

[Effect of the Invention] Thus, aluminum alloy composite of this invention shows the corrosion resistance which was excellent in both alkaline and acid environments, and is high corrosion resistance. Furthermore, since it can consider as tube tubing by bending processing, lightweight-ization of the heat exchanger made from aluminum alloy can be attained by carrying out the thinning of the aluminum alloy composite. Moreover, brazing junction can be performed without performing welding by **** processing, and the thinning of ******** can be performed. Moreover, the pressure resistance of a heat exchanger can be raised by 2 division of a tube. Therefore, remarkable effectiveness is done so on industry.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the place where this invention person etc. examined said advanced composite, it became clear with said advanced composite that sufficient corrosion resistance was not acquired in an alkaline environment. As this cause, it is ********** in a putting [since the aluminum-oxide coat of a sacrificial anode material front face dissolves promptly in ** alkali environment, a substrate metal will be exposed at an early stage, and / a substrate metal]-to alkali environment ** alkali environment that the dissolution rate of a substrate metal is very large. this invention person etc. could advance research wholeheartedly, could consider as tube tubing by bending processing, and succeeded in development of aluminum alloy composite which has the corrosion resistance which was excellent in both alkaline and acid environments.

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MEANS

[Means for Solving the Problem] In aluminum alloy composite for heat exchangers of the three-tiered structure which invention according to claim 1 carried out the clad of the wax material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other one side of a core material About said wax material, it is Si. 6.0 - 12.0 % of the weight (it is hereafter written as %), Li Contain 0.01 - 0.3% and it considers as aluminum alloy which consists of the remainder aluminum and an unescapable impurity. About said sacrificial anode material, it is Mg. 0.3 - 1.5%, Mn 0.5 - 1.5%, Zn It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 1.0 - 6.0% and consists of the remainder aluminum and an unescapable impurity. It sets to aluminum alloy composite according to claim 1, and invention according to claim 2 is 0.05 - 1.2% of Si, and Fe about a core material. 0.05 - 0.8%, Cu 0.05 - 1.2%, and Mn It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains 0.05 - 2.0% and consists of the remainder aluminum and an unescapable impurity. Invention according to claim 3 is set to aluminum alloy composite according to claim 1. A core material 0.05 - 1.2% of Si, Fe 0.05 - 0.8%, Cu 0.05 - 1.2%, Mn 0.05 - 2.0% is contained. Furthermore, Mg 0.03 - 1.0%, 0.03 - 0.3% of Cr(s), Zr 0.03 - 0.3%, Ti 0.03 - 0.3%, and nickel It is corrosion-resistant aluminum alloy composite for heat exchangers characterized by considering as aluminum alloy which contains one sort chosen from the group which consists of 0.05 - 2.0%, or two sorts or more, and consists of the remainder aluminum and an unescapable impurity. In this invention, although alkalinity is specifically eight or less pH although especially an alkaline and acid definition does not differ from usual, and acidity says five or less pH, it is not restricted to this.
[0007]
[Embodiment of the Invention] Next, this invention is further explained to a detail based on an embodiment. aluminum alloy sacrificial anode material of invention of claim 1 gives alkali resistance to sacrificial anode material by making aluminum contain Mg. By adding Mg to sacrificial anode material, a magnesium-oxide coat is formed in a sacrificial anode material front face after soldering heating. Since said magnesium-oxide coat has the dissolution rate very smaller than an aluminum-oxide coat in an alkali environment, exposure of a substrate metal can be made delayed sharply. Moreover, although it is accompanied by the hydrogen generating reaction in case aluminum dissolves in an alkali environment, by making sacrificial anode material carry out specified quantity content of Mn, the hydrogen overvoltage of sacrificial anode material can be enlarged and the dissolution at a hydrogen generating reaction, i.e., an alkali environment, can be controlled. Furthermore, in addition, the hydrogen overvoltage of sacrificial anode material can be further enlarged by making sacrificial anode material add Zn of the specified quantity. While making the dissolution in an alkali environment control further by this, in an acidity - neutral environment, natural electrode potential of sacrificial anode material can be made into **, an original sacrifice corrosion prevention operation can be demonstrated, and the corrosion resistance in an acid environment can be secured.
[0008] As mentioned above, by making a proper quantity of Mg, Mn, and Zn live together in sacrificial anode material showed that alkalinity and the outstanding corrosion resistance in an acid environment

could be given to tube tubing. However, when Mg is added to the sacrificial anode material of aluminum alloy composite, there is a problem that aluminum alloy composite cannot be used as said bending tube tubing. This is because the fluoride flux used as flux and Mg in sacrificial anode material react, the effectiveness of flux is lost in order to form a high-melting compound, and soldering becomes impossible. It turned out that this invention person etc. can advance research further wholeheartedly, is adding Li of the specified quantity to the wax material of said composite, and can manufacture tube tubing as a bending tube and it can solder as a heat exchanger even when Mg contains in sacrificial anode material.

[0009] Since LiF will be formed before MgF forms if Li is added to wax material, this is considered because there is an operation which controls formation of MgF which checks soldering nature. Since this LiF is in a melting condition in flux, it deposits as a solid-state like MgF with the high melting point, and is not said that the flow of a wax is checked. Furthermore, since Li is effective in reducing the surface tension of aluminum alloy remarkably, it raises the flow nature of a wax. By making wax material add Li of the specified quantity according to such effectiveness, when Mg content of sacrificial anode material was 1.5% or less, it became clear by the approach of using as tube tubing by bending processing that a heat exchanger with good soldering was obtained.

[0010] In invention of claim 1, the reason for specifying Mg content of sacrificial anode material to 0.3 - 1.5% is that the effectiveness of alkali-proof improvement is not fully acquired since a magnesium-oxide coat is not completely formed in a sacrificial anode material front face for Mg content at less than 0.3%. If Mg content exceeds 1.5%, since excessive Mg will react with flux, Li of this invention will be deposited as MgF, even if it uses specified quantity **** wax material and the flow of a wax will be blocked, tube tubing bent and processed cannot be soldered. Especially the content of desirable Mg is 0.3 - 1.0%. The reason for specifying Mn content of sacrificial anode material to 0.5 - 1.5% is because the effectiveness that Mn content lowers a hydrogen overvoltage at less than 0.5% is not fully acquired and the dissolution of the substrate metal in an alkali environment cannot be controlled. If Mn content exceeds 1.5%, the rolling workability of sacrificial anode material will fall.

[0011] Moreover, the reason for specifying Zn content of sacrificial anode material to 1.0 - 6.0% is because the effectiveness that Zn content lowers a hydrogen overvoltage at less than 1.0% is not fully acquired and the dissolution of the substrate metal in an alkali environment cannot be controlled. Furthermore, since natural electrode potential of sacrificial anode material cannot be enough made into **, the sacrifice corrosion prevention effectiveness over a core material will run short, and the corrosion resistance in an acid environment will be inferior. If Zn content exceeds 6.0%, when Mg content is contained in sacrificial anode material 0.3 to 1.5%, the rolling workability of sacrificial anode material will fall. Especially the content of desirable Zn is 2.0 - 6.0%. 0.5% or less, 0.3% or less of Si of the unescapable impurity element in sacrificial anode material is desirable, if it can do. If impurity elements other than Si are 0.05% [or less] each, even if they are contained, they are satisfactory.

[0012] In invention of claim 1, Si of wax material serves to lower the melting point of an alloy. Since the melting point will go up if the melting point of wax material does not fully fall at less than 6.0% but Si content exceeds 12.0%, the reason for specifying Si content of wax material to 6.0 - 12.0% cannot be soldered. Moreover, the reason for specifying Li content of wax material to 0.01 - 0.3% is that a thick oxide film will be formed in the front face of sacrificial anode material of oxidation of Li, and soldering nature will fall if the effectiveness that Li content controls formation of MgF required for soldering for the sacrificial anode material which contains Mg at 0.01% or less is not enough and Li content exceeds 0.3%. aluminum alloy composite of this invention makes said aluminum alloy sacrificial anode material one side of aluminum alloy core material, and makes the clad of said aluminum alloy wax material to other one side.

[0013] Next, the alloy element of claim 2 and aluminum alloy core material according to claim 3 is explained. After soldering, Si dissolves in a matrix and raises the reinforcement of a core material. At less than 0.05%, the reason for specifying the content of Si to 0.05 - 1.2% is for Si to deposit alone and for the self-corrosion resistance of a core material to make it fall, when the effectiveness of raising reinforcement is not fully acquired but exceeds 1.2%. 0.1 - 0.8% of especially the content of Si is

desirable. Fe is distributed in a matrix as a big and rough intermetallic compound, makes crystal grain of a core material detailed, and prevents generating of the crack when fabricating in tube tubing. At less than 0.05%, the reason for specifying the content of Fe to 0.05 - 0.8% is for the self-corrosion resistance of a core material to fall, when the effectiveness is not acquired enough but exceeds 0.8%. 0.05 - 0.3% of especially the content of Fe is desirable.

[0014] Cu contributes to the improvement in on the strength of a core material. At less than 0.05%, the reason for specifying the content of Cu to 0.05 - 1.2% is for the melting point to fall and for a core material to fuse locally with heating at the time of soldering, when the effectiveness of raising reinforcement is not acquired enough but exceeds 1.2%. Mn forms a detailed intermetallic compound, is distributed in a matrix, and it raises the reinforcement of a core material, without reducing corrosion resistance. At less than 0.05%, the reason for specifying the content of Mn to 0.05 - 2.0% is for rolling workability to fall, when the effectiveness of raising reinforcement is not fully acquired but exceeds 2.0%. 0.5 - 1.5% of especially the content of Mn is desirable.

[0015] In the core material of aluminum alloy composite of this invention, each Cr, Zr, Ti, and nickel of a selection element form a detailed intermetallic compound, and raise the reinforcement of a core material. The reason for specifying the content of Cr, Zr, and Ti to 0.03 - 0.3%, respectively is for the occurrence frequency of the flume gap to which the effectiveness of all raising reinforcement by Suemitsu 0.03% is not acquired enough, but exceeds 0.3% of a casting crack to increase. Especially the desirable content of these elements is 0.08 - 0.2%, respectively. Although the content of nickel is specified to 0.05 - 2.0%, the reason for a convention is the same as cases, such as said Cr. Especially the desirable content of nickel is 0.08 - 1.0%.

[0016] With Si, Mg of a selection element carries out the aging deposit of the Mg-Si system compound, and raises reinforcement. The reason for specifying the content of Mg to 0.03 - 1.0% is for the amount of Mg diffused even on a wax material front face in the case of soldering to increase, for Surplus Mg to react with fluoride flux, even if it has added Li to wax material like this invention, and for soldering nature to fall, when the effectiveness of raising reinforcement at less than 0.03% is not acquired enough but exceeds 1.0%. If B for making an ingot organization detailed or other unescapable impurity elements are 0.05% [or less] each, even if it contains them, they do not interfere.

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EXAMPLE

[Example] This invention is further explained to a detail based on an example.
(Example 1) Metal mold casting of the wax material alloy of this invention convention presentation shown in Table 1, a sacrificial anode material alloy, and the core material alloy was carried out, respectively, facing of the ingot for core materials was carried out to 35mm in thickness, and after facing, the ingot for sacrificial anode material was hot-rolled, and was taken as the plate with a thickness of 10mm. Moreover, after facing, the ingot hot-rolled the wax material alloy and used it as the plate for wax material with a thickness of 5mm. Said plate for sacrificial anode material, the ingot for core materials, and the plate for wax material were hot-rolled at 500 degrees C in piles in this order, it considered as the three-layer clad plate with a thickness of 5mm, and this was cold-rolled in thickness of 0.29mm, after giving intermediate annealing subsequently heated at 340 degrees C for 2 hours, it cold-rolled and aluminum alloy composite (H14 material) with a thickness of 0.25mm was manufactured. The rate of a clad of wax material of the rate of a clad of sacrificial anode material was 10% 20% here. The rate of a clad is expressed with a degree type in this invention.
the rate = sacrificial anode of a clad of sacrificial anode material -- stock thickness -- the rate = wax of a clad of /board thickness x100 wax material -- stock thickness -- /board thickness x -- 100 [0018]
(Example 1 of a comparison) The alloy presentation of a core material, sacrificial anode material, and wax material was made into the outside of this invention convention presentation as shown in Table 1, and also aluminum alloy composite was manufactured by the completely same approach as an example 1. About each obtained aluminum alloy composite, the soldering trial and the corrosion resistance test were performed. The corrosion resistance test followed both the acid environment and the alkaline environment. Investigation with the same said of the conventional material was conducted.
[0019] [Soldering trial] Each aluminum alloy composite was cut to 25mmx60mm, and T joint joint soldering trial was carried out. In order to simulate the soldering section of a bending tube, the horizontal plate of T joint joint made the field which touches a vertical panel sacrificial anode material. After applying the non-corrosive fluoride flux which becomes assembled T joint joint from a fluoro ulmin **** RIUMU complex two times 5 g/m, it held for 3 minutes at 600 degrees C in nitrogen gas, and soldered each 30 sets of T joint joints. The existence of a wax piece was evaluated by viewing about the soldered sample. What generating of O and a wax piece was regarded as in what a wax piece was not regarded as at all was made into x. This trial is equivalent to the brazing sex test of the comparison section A in drawing 3 of this invention.
[0020] [Corrosion resistance test] Bending processing was performed, it considered as tube tubing (die length of 500mm, width of face of 16mm of a cross section, height of 2mm), the heat exchanger of the structure shown in drawing 1 using this tube tubing was assembled, and this heat exchanger was made to circulate through alkaline or acid etching fluid (80 degrees C) for three months about aluminum alloy composite which was able to be soldered by said soldering trial. Then, it sampled ten tube tubing at a time at random from each heat exchanger, and the pitting depth of a tube material inside was measured by the depth of focus method using an optical microscope. Measured value was rounded off, was expressed per 5 micrometers, and displayed the maximum depth of them. What carried out corrugated

processing of the sheet metal material with a thickness of 0.1mm it is thin from an aluminum-0.5%Si-1.0%Mn-2.0%Zn alloy was used for the fin. it passed and aluminum alloy composite with a thickness of 1.2mm which, on the other hand, looked like [one side of the core material which added Mg 0.15% into JIS-3003 alloy] the sacrificial anode material of an aluminum-1.5%Zn alloy, and carried out the clad of the wax material of JIS-4343 alloy to the DDA plate and the side plate at 10% of rates of a clad, respectively was used.

[0021] The liquid which added NaOH in the water solution which contains Cl-ion 195ppm, SO42-ion 60ppm, Cu2+ ion 1ppm, and Fe3+ ion 30ppm in alkaline etching fluid, and was adjusted to pH11 was used. The water solution (pH3) containing Cl-ion 195ppm, SO42-ion 60ppm, Cu2+ ion 1ppm, and Fe3+ ion 30ppm was used for acid etching fluid. A result is shown in Table 1. In addition, x and the maximum pitting depth appended O to that to which the maximum pitting depth exceeded 100 micrometers in the alkaline corrosion test and the acid corrosion test at the thing 100 micrometers or less.

[0022]

[Table 1]

表1

分類	No	ろう材組成 %		犠牲陽極材組成%				芯材組成 %						ろう付性	アルカリ性環境	酸性環境
		Si	Li	Zn	Mg	Mn	Si	Fe	Cu	Mn	Cr Zr Ti Mg Ni				最大孔食深さ μm	最大孔食深さ μm
本発明例	1	6.8	0.25	1.2	1.41	0.55	0.37	0.51	0.42	1.52				○	35	○ 60
	2	10.5	0.02	1.8	0.63	1.09	0.34	0.25	0.16	1.10				○	55	○ 55
	3	10.2	0.09	2.1	0.57	0.85	0.22	0.21	0.32	0.98				○	60	○ 50
	4	10.8	0.06	3.5	0.56	0.81	0.31	0.19	0.61	1.06				○	60	○ 40
	5	9.7	0.14	4.1	0.63	1.25	0.33	0.28	0.80	1.23				○	50	○ 45
	6	10.0	0.04	5.5	0.75	1.30	0.48	0.15	0.15	1.05				○	45	○ 30
	7	11.5	0.12	5.1	0.66	0.74	0.61	0.30	0.35	0.94				○	50	○ 30
	8	10.2	0.06	1.4	1.27	1.41	0.61	0.25	0.48	1.15				○	30	○ 60
	9	10.6	0.18	2.7	1.10	0.89	0.54	0.16	0.75	0.89				○	30	○ 55
	10	9.8	0.09	3.2	1.08	1.19	0.81	0.26	0.16	1.32				○	35	○ 60
	11	7.9	0.11	4.6	1.13	0.72	0.96	0.11	0.34	1.40				○	40	○ 45
	12	8.5	0.07	5.7	0.97	1.26	0.76	0.45	0.53	0.79				○	40	○ 35
	13	10.3	0.15	5.2	1.28	1.03	0.71	0.32	0.86	1.10				○	35	○ 35
	14	10.2	0.08	4.0	0.81	0.93	0.12	0.21	0.09	1.52	Cr 0.14			○	45	○ 40
	15	9.6	0.03	3.8	0.92	0.67	1.09	0.70	0.40	0.09	Zr 0.12			○	40	○ 45
	16	10.7	0.09	4.8	1.23	0.88	0.82	0.29	1.03	1.21	Ti 0.18			○	35	○ 55
	17	10.1	0.19	4.2	0.33	0.97	0.42	0.32	0.52	0.98	Mg 0.67			○	55	○ 50
	18	9.6	0.04	3.7	0.97	1.02	0.56	0.10	0.53	1.07	Ni 1.05			○	45	○ 40
比較例	19	10.6	-	2.8	0.75	0.82	0.62	0.34	0.18	1.04				×	熱交換器を製造できなかった	
	20	9.1	0.01	3.6	0.83	0.72	0.54	0.28	0.56	0.94				×	熱交換器を製造できなかった	
	21	10.3	0.53	5.3	1.02	1.04	0.36	0.45	0.45	1.15				×	熱交換器を製造できなかった	
	22	10.9	0.09	3.4	0.34	1.31	0.74	0.18	0.73	1.08				○	貫通 ×	70 ○
	23	10.1	0.07	1.9	1.95	0.94	0.34	0.21	0.42	0.80				×	熱交換器を製造できなかった	
	24	9.4	0.09	0.64	1.01	1.24	0.18	0.32	0.24	0.93				○	85 ○	180 ×
	25	10.5	0.13	10.5	0.96	1.10	0.52	0.27	0.45	1.07				圧延途中で割れて製造不可		
	26	8.2	0.08	2.6	0.82	1.42	0.39	0.46	0.87	1.26				×	熱交換器を製造できなかった	
	27	10.6	0.12	3.6	0.95	0.73	1.35	0.35	0.53	0.88				○	130 ×	140 ×
	28	9.3	0.17	5.3	0.79	0.88	0.41	0.51	1.85	0.79				芯材がろう付け加熱時に溶融		
	29	10.7	0.13	2.7	1.05	1.13	0.63	0.25	0.60	1.32	Mg 1.57			×	熱交換器を製造できなかった	
従来例	30	10.0	-	1.0	-	-	0.31	0.42	0.15	1.10				○	貫通 ×	90 ○

[0023] Li of the specified quantity is contained in wax material, No.1-18 of the example of this invention would shine, the sex was good, since Mg, Mn, and Zn of the specified quantity were contained in sacrificial anode material, in the corrosion test of both alkaline and acid environments, the pitting depth is 100 micrometers or less, and the outstanding corrosion resistance was shown, so that more

clearly than Table 1. On the other hand, the alloy presentation was what the example of a comparison (No.19-29) and the conventional example (No.30) besides this invention convention were inferior to soldering nature, or corrosion resistance fell by alkalinity or the acid corrosion test, or cannot manufacture ******** or a heat exchanger.

[0024] No. -- 19 and 20 had few Li contents of wax material, and since Mg was contained in sacrificial anode material, the wax piece was generated and they were inferior in soldering nature. Since No.21 had too many Li contents of wax material, the wax material front face oxidized violently, the oxide film became thick unusually, and they were inferior in soldering nature. There were few Mg contents of sacrificial anode material, and a substrate metal was not fully protected, and since the dissolution rate of a substrate metal was large, the corrosion resistance in an alkali environment was inferior in No.22, since a magnesium-oxide coat was not fully formed. Since No.23 had too many Mg contents of sacrificial anode material, even if it was making wax material contain Li, the wax piece was generated, and they were inferior to soldering nature. Since No.24 had few Zn contents of sacrificial anode material, sufficient sacrifice corrosion prevention effectiveness was not demonstrated in the acid environment, but corrosion resistance was inferior in them. No.25 had many Zn contents of sacrificial anode material, since they contained Mg further, sacrificial anode material is in the middle of rolling, they broke, and manufacture of composite of them was not completed.

[0025] Since No.26 had few Si contents of wax material, its melting of wax material was imperfect and was not able to solder them. Since No.27 had many Si contents of a core material, the simple substance Si deposited in the core material, and the self-corrosion resistance of a core material fell in alkalinity and both acid environments. Since No.28 have too many Cu contents of a core material, the melting point of a core material fell and the core material of composite has fused them at the time of a soldering trial. Since No.29 had too many Mg contents of a core material, Mg of a core material diffused them at wax material in the middle of soldering heating, they reduced the effectiveness of Li contained in wax material, and were inferior in soldering nature. Moreover, although No.30 were the conventional example, since Mg was not contained in sacrificial anode material, a magnesium-oxide coat was not fully formed, and the dissolution rate of a substrate metal was large, and the corrosion resistance in an alkali environment was inferior.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

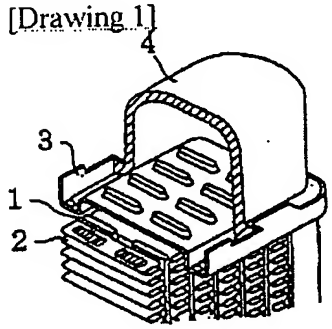
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view cutting and showing a part of radiator for corrosion-resistant aluminum alloy composites of this invention.
[Drawing 2] It is the sectional view which illustrated the tube manufactured by **** processing using composite.
[Drawing 3] It is the sectional view which illustrated the tube which bends using composite and is manufactured by processing.
[Description of Notations]
1 Tube Tubing
2 Corrugated Fin
3 Header Plate
4 Tank
5 Core Material
6 Wax Material
7 Sacrificial Anode Material
8 Comparison Section
9 Refrigerant Path
10 Inside Column
11 Tube Tubing
A Comparison section

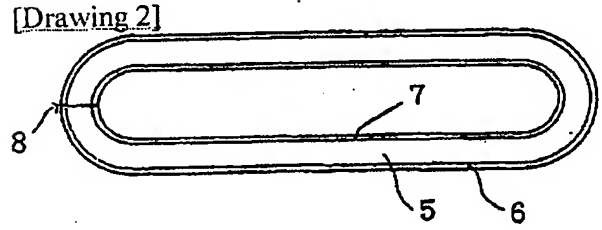
[Translation done.]

DRAWINGS

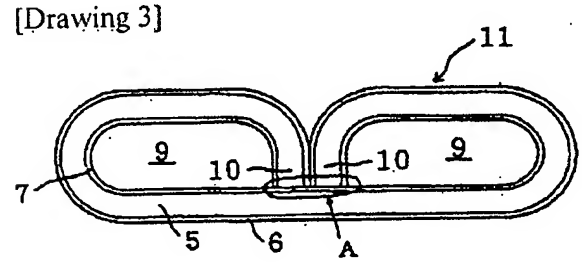
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]